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13. ABSTRACT (Maximum 200 words) This work focuses on continuing to develop an effective interface to capture and log the raw hydrophone and supporting data. The objectives are to design and implement a data acquisition scheme that preserves calibrated base-banded quadrature samples of the output of individual hydrophone staves and the required supporting data for use with modern signal processing and swath mapping techniques. The initial approach consisted of tapping the pre-existing digital output of each hydrophone channel, performing a base-banding operation and retaining enough samples to provide about twice the Nyquist rate for later processing. Due to the limited dynamic range of the existing converters, this design was not suitable. A prototype which acquired raw analog data at the output of the existing preamplifier using Crystal Semiconductor (CS-5336) dual channel, 16-bit delta-sigma converters with a high quality differential amplifier front end was built and tested briefly, but a full system was not built due to lack of resources.				
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Final Technical Report For Contract
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Backscatter data acquisition for Hydrosweep DS aboard R.V. Ewing.

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LONG TERM GOALS

The long term objective of this work is to develop an efficient and accurate interface to the raw stave data from the Hydrosweep DS on the *Ewing* to allow subsequent processing and analysis.

SCIENTIFIC/TECHNOLOGICAL OBJECTIVES

This work focuses on continuing to develop an effective interface to capture and log the raw hydrophone and supporting data. The objectives are to design and implement a data acquisition scheme that preserves calibrated base-banded quadrature samples of the output of individual hydrophone staves and the required supporting data for use with modern signal processing and swath mapping techniques.

BACKGROUND

An Atlas Hydrosweep DS multibeam swath sonar was installed on the Ewing in 1990. Subsequent to the installation [Chayes, 1991] and improvements in the performance of the system [Chayes et. al. 1991], there was significant interest in capturing and analyzing the raw waveform data from the system.

Initial investigations into the architecture and characteristics of the Hydrosweep were carried out in 1990 and 1991 and in consultation with Christian de Moustier of the Marine Physical Laboratory, it became clear that the existing signal processing was not adequate for seafloor characterization (such as in de Moustier and Alexandrou, 1991) and that improvements in the bathymetric and image data quality could be achieved using methods including those described in de Moustier, 1993 if higher quality raw data could be obtained.

APPROACH

The initial approach consisted of tapping the pre-existing digital output of each hydrophone channel, performing a base-banding operation and retaining enough samples to provide about twice the Nyquist rate for later processing.

These acoustic data would then be recorded along with system parameters such as gain settings, pulse length, and transmission mode, and ship attitude data.

ACCOMPLISHMENTS & RESULTS

After reviewing the internal functions of the Hydrosweep DS system, we designed a data acquisition and signal processing architecture and set out to implement it aboard ship. The first attempt to capture the existing digital data stream was conducted during the geophysical survey of the ONR Acoustic Reverberation SRP in July 1992. After developing an interface technique to overcome the complexities of the existing interface, we acquired and evaluated some sample data. This onboard evaluation indicated that the existing 8-bit digital data was not suitable because of its low dynamic range.

A second attempt was made on a not-to-interfere basis during a multibeam and dredging cruise on the Ewing led by Jean Guy Schilling to the South Atlantic in December 1993. For this effort, we acquired raw analog data at the output of the existing preamplifier using Crystal Semiconductor (CS-5336) dual channel, 16-bit delta-sigma converters with a high quality differential amplifier front end. A two channel prototype was built and tested on this leg. Figure 1 shows the time series and frequency domains of a single bottom return collected on December 23, 1993 with the prototype analog interface. Figure 2 shows the filtered time series and frequency domain for five bottom returns over time.

Support for this effort at Lamont declined before the acquisition system could be made implemented and made operational. Efforts continue to find a source of funding to complete this project.

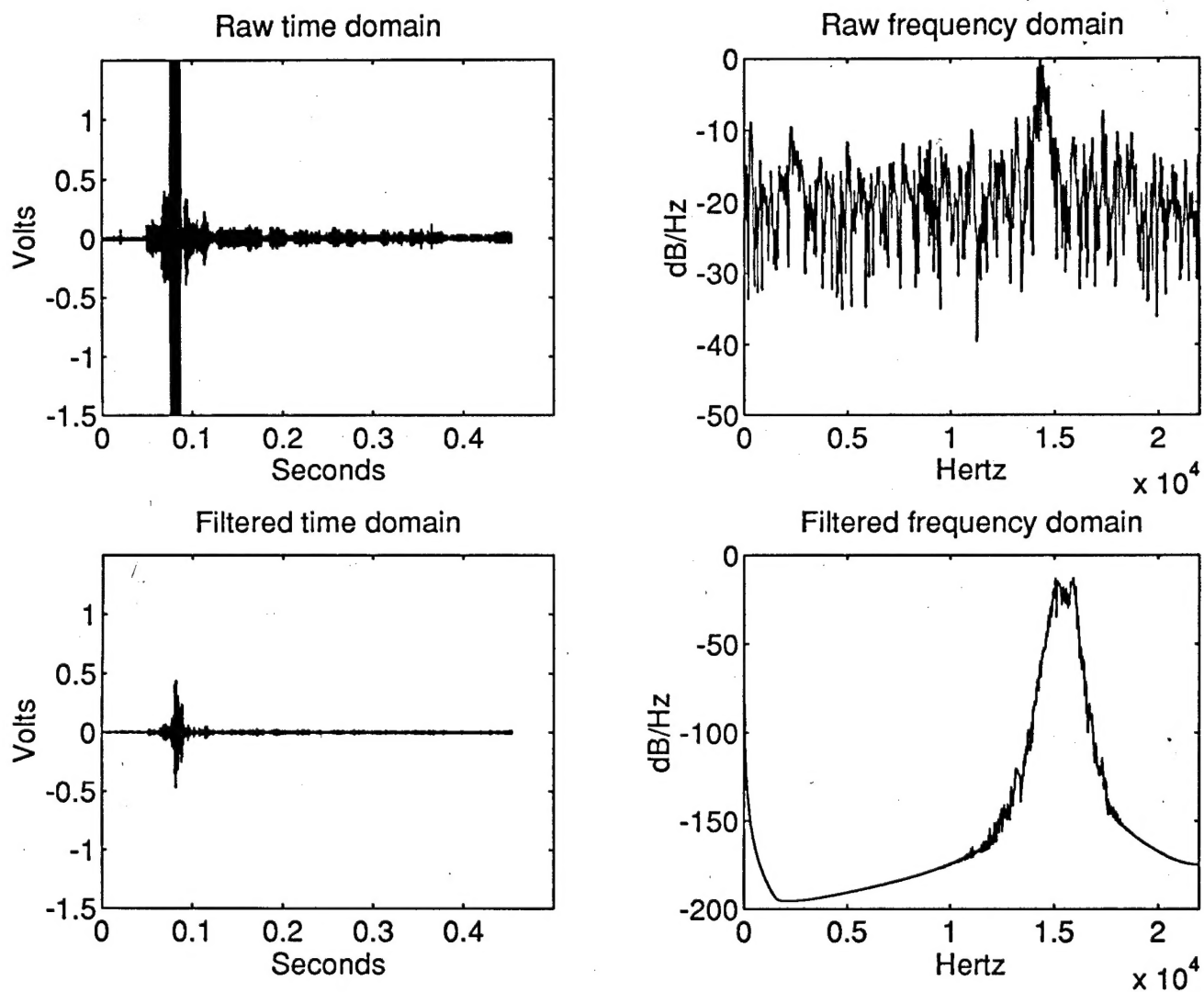


Figure 1 One bottom return collected with the prototype analog interface

The two plots on the left are time series data before (top) and after (bottom) application of a narrow band filter. The plots on the right are frequency domain representations of the time series data.

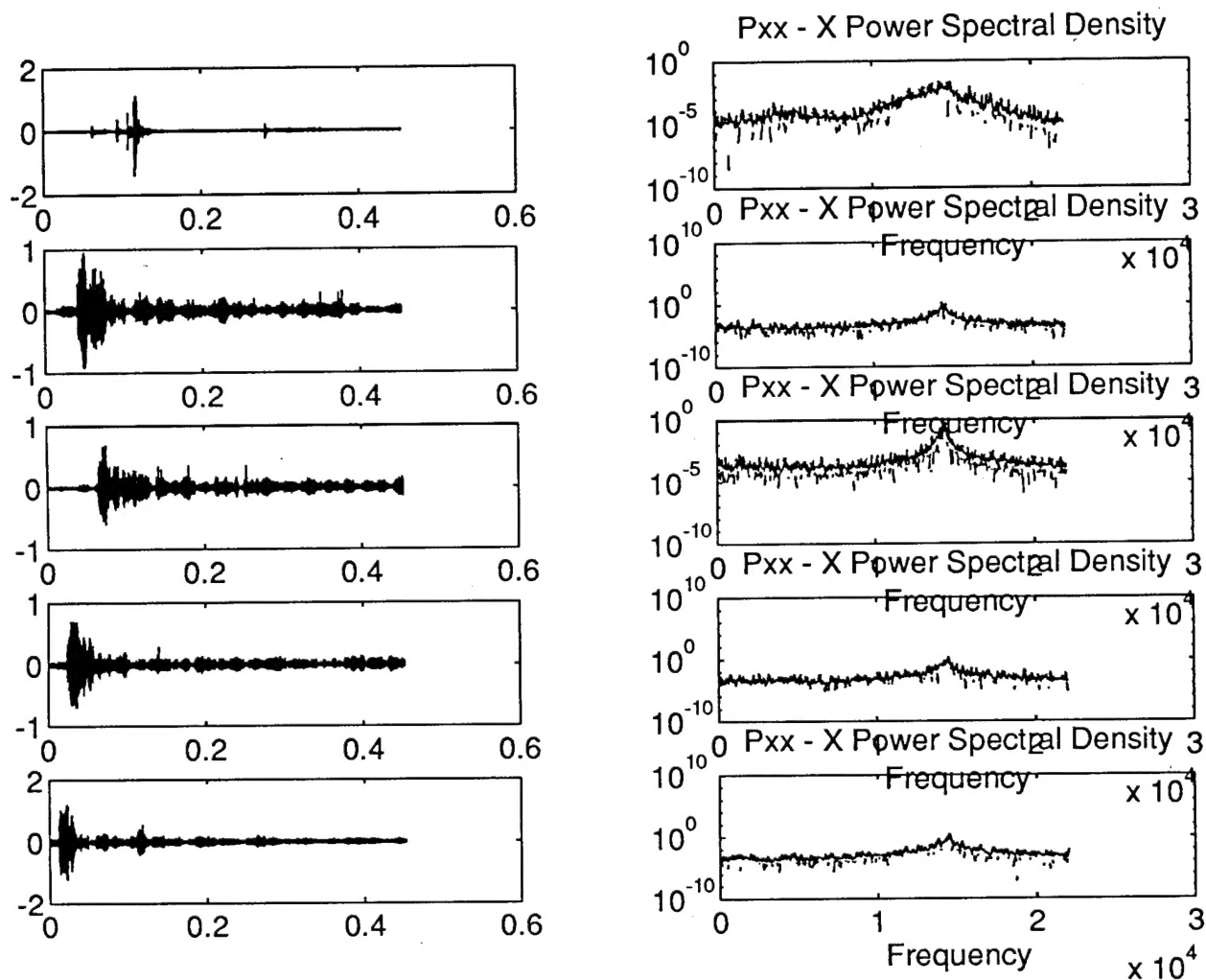


Figure 2 Bottom returns from the two channel prototype

Plots in the left column are time series of filtered bottom returns acquired by the two channel prototype interface. The right column contains power spectra of the acquired data.

REFERENCES

Chayes, D.N., Hydrosweep on the R/V Ewing, Proceedings of the IEEE Oceans 91 conference, p. 737-742, 1991.

Chayes, D.N., D.W. Caress, W.B.F. Ryan, A. Malinverno, W. Menke, C. Keeley, "Status of Hydrosweep on the R/V Ewing: system operation and data processing", EOS, Trans. Am. Geoph. U., 72 (44), 448, 1991.

de Moustier, C., and D. Alexandrou, "Angular dependence of 12 kHz seafloor acoustic backscatter", J. Acoust. Soc. Am., 90(1), 522-531, 1991.

C. de Moustier, "Signal processing for swath bathymetry and concurrent seafloor acoustic imaging", in Acoustic Signal Processing for Ocean Exploration, NATO ASI, Moura & Lourtie Eds., Kluwer Pub., 329-354, 1993.